3GPP RAN workshop on 5G

Phoenix, USA, Sep. 17 - 18, 2015

RWS-150067

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Convergent Broadband And Wireless Networks

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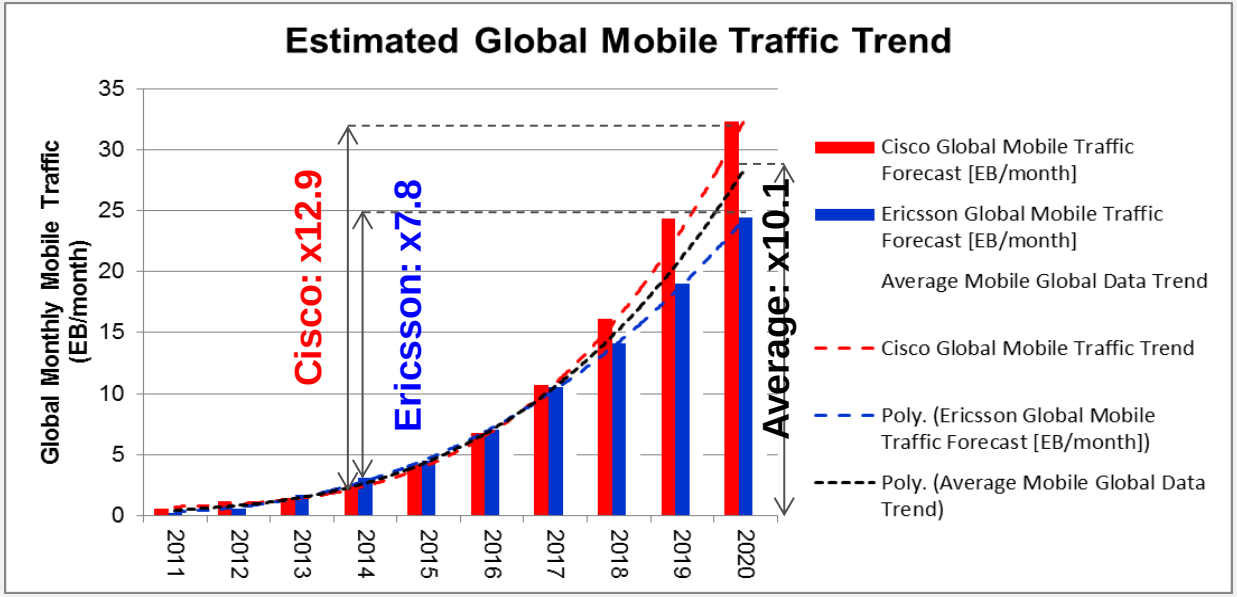
Global Mobile Data Forecast [1,2]



- The estimated average global mobile data growth between 2014-20: x10
- The actual wireless technologies can't support an exponential global mobile traffic growth.
- **A new set of wireless technologies (5G), with no "baggage" compatibility, should emerge.**

Assumptions:

- Cisco's estimated global mobile data traffic for 2020 are extrapolated based on the trend pattern.
- Mobile data projections include smartphones, mobile laptops, tablets and M2M traffic.

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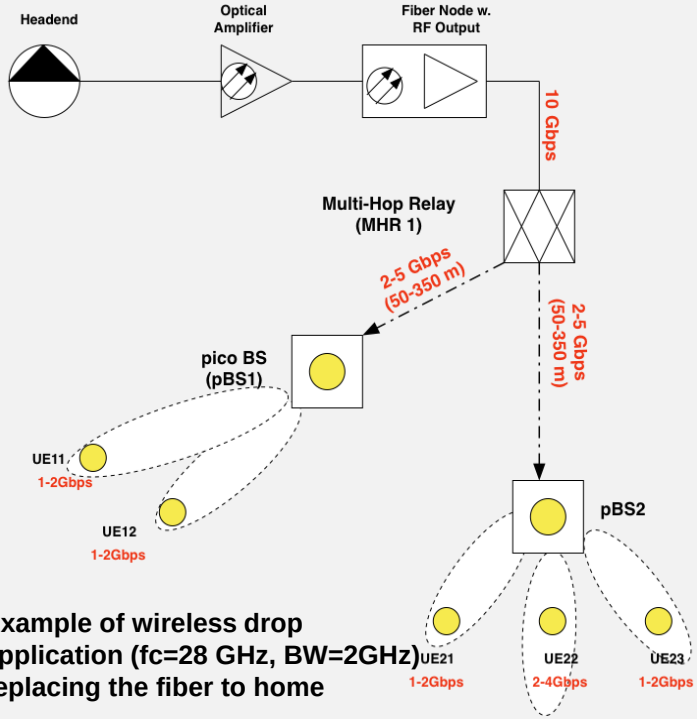
5G mm Band Communications



Example of wireless drop application (fc=28 GHz, BW=2GHz) replacing the fiber to home

The 5G mm wave networks are expected to:

- Make use of some of the 20-100 GHz bands (e.g. 27.5-29.5 GHz, 37.0-40.0, 71-76 and 81-86 GHz);
- Provide cell throughput capabilities of 1+ Gbps;
- Provide latencies <3 ms per cell

The mm wave bands will address the exponential throughput increase in the global mobile data trends (slide #1).

In order to support 10+ Gbps throughput and very low end-to-end latencies, fixed broadband networks are required to support user centric traffic, jointly with wireless networks.

Clusters of mm wave small cells will require high capacity optical backhaul support

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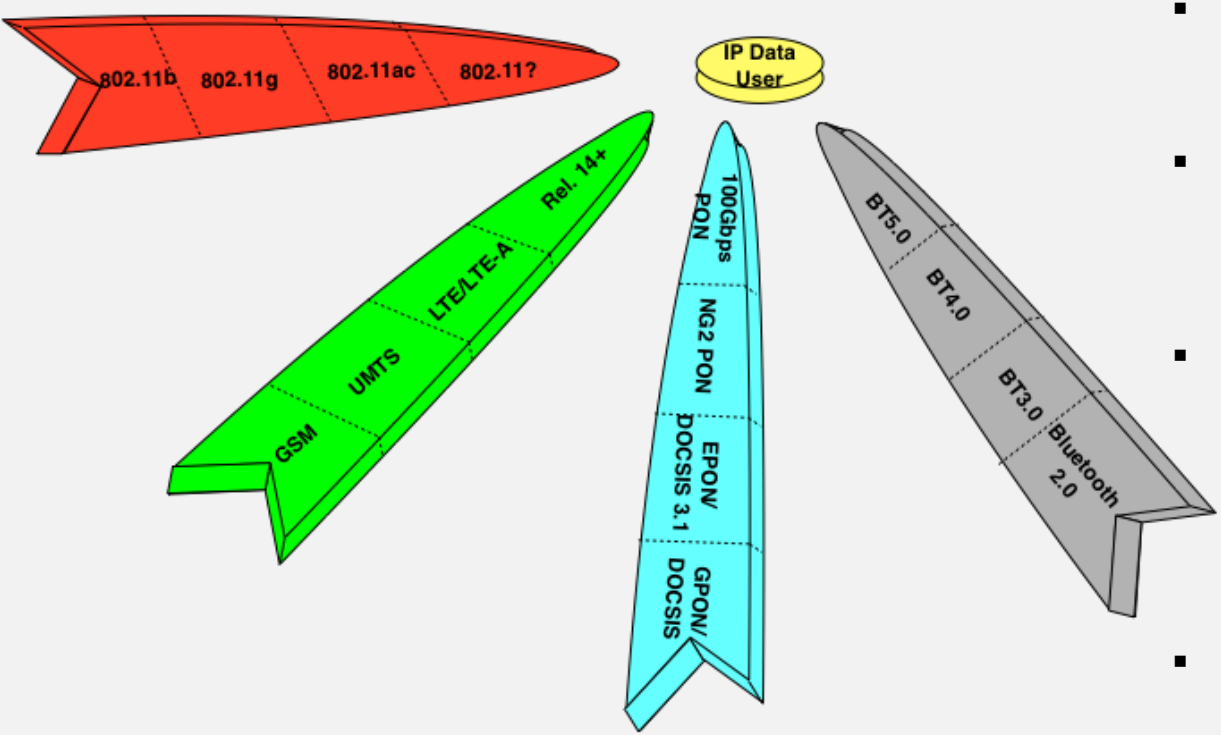
User Centric Networks



- The high throughput over wireless networks is fueled by M2M traffic.
- A high degree of convergence between fixed, mobile and personal networks is expected to emerge.
- 40 Gbps (NG2 PON) networks move towards the next 100 Gbps barrier.
- Personal Area Networks (PAN) evolve toward larger coverage and data rates.
- Wi-Fi networks increased their throughput and flexibility.

5G networks are expected to be user centric: one user, many networks.

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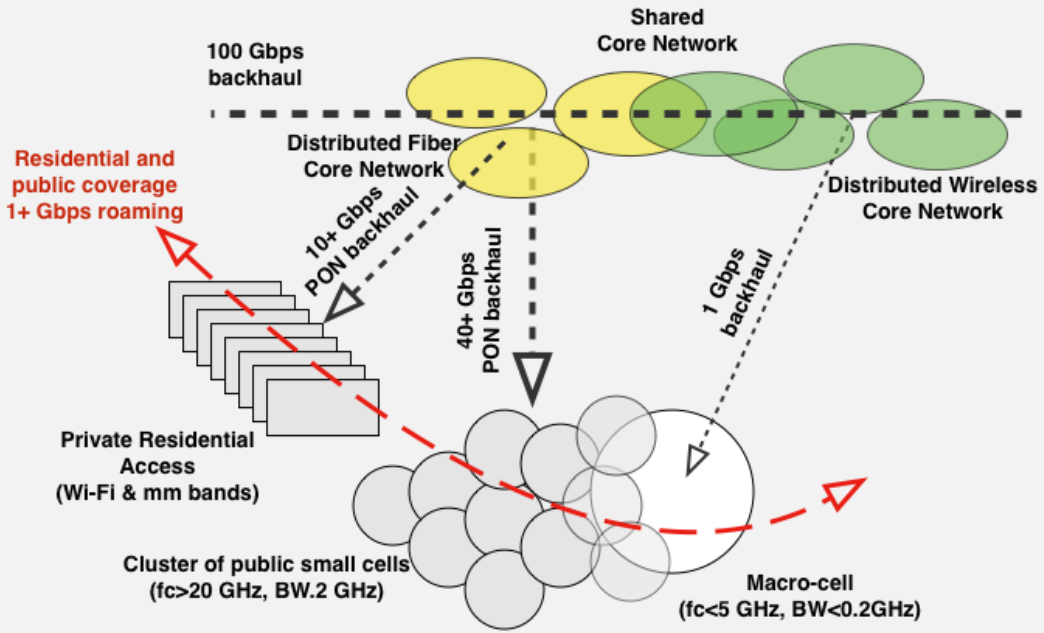
Converged Broadband-Wireless Network Capability



Rolling out small cells clusters based on mm bands with large BW (e.g. 4GHz) may require backhaul capacities in excess of 40 Gbps. This may be supported by an integrated broadband and wireless network:

- The user could roam seamlessly between residential, office and public areas, while being provided <3ms @1+ Gbps access capability.
- The broadband networks will get mobility support across clusters of mm band small cells and possible share macro-cells access.
- The wireless networks get access to <3ms @100Gbps PON backhaul and residential areas.
- Aggregating 30+ carriers between 0 to 100 GHz (RF and cable) may become possible.

Converged broadband-wireless networks could provide users with <3 ms @1+ Gbps data transfer services while roaming across residential, office and public spaces.

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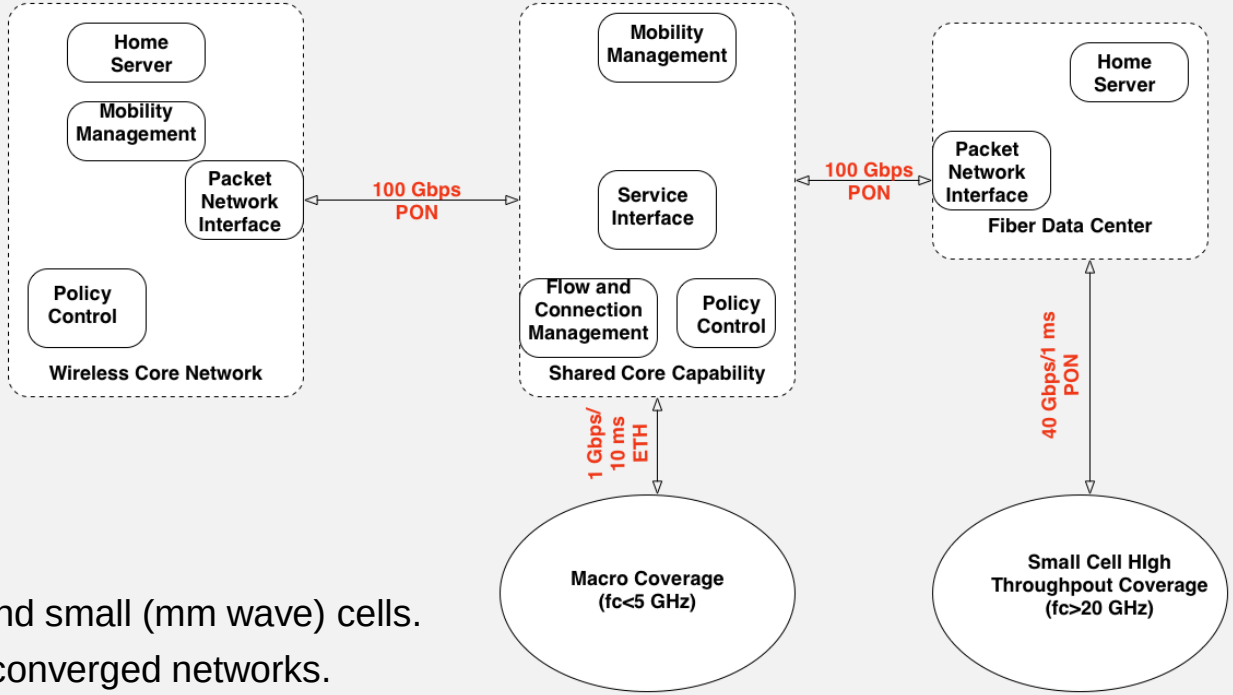
Inter Access Technology



Shared core capability could support

- Joint 40+ Gbps @ <3ms backhaul.
- Joint or separate access to macro and small (mm wave) cells.
- Cross-roaming and mobility across converged networks.
- Aggregated carrier access

Inter Access Technology (IAT) is enabled by an optimized shared core between broadband and wireless networks, based on a distributed architecture.

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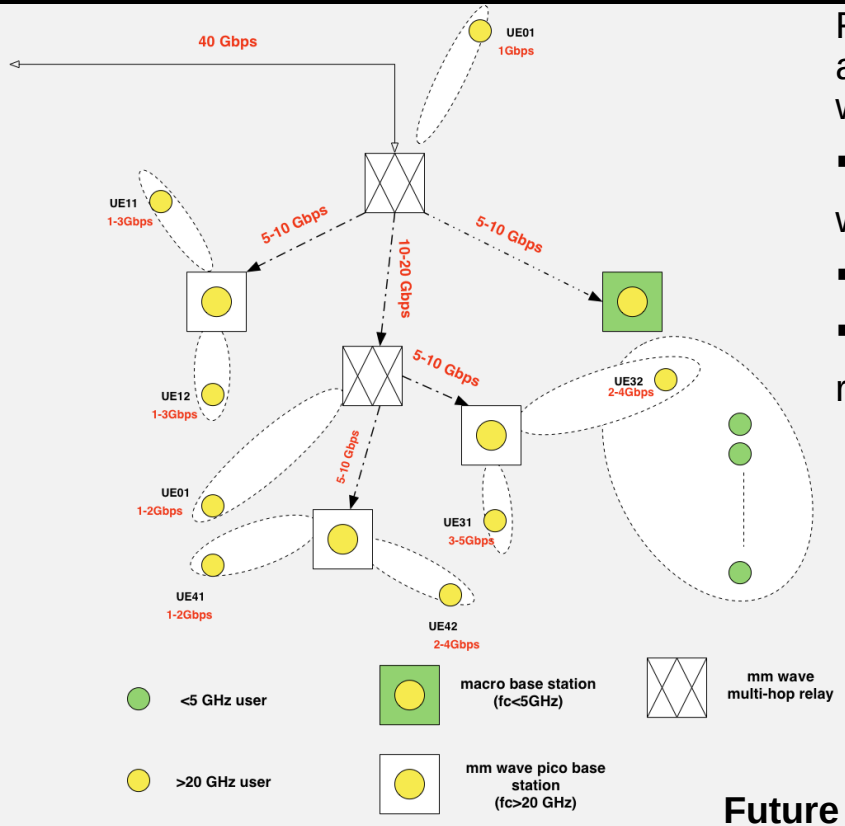
Shared Access Capability



Future broadband wireless networks may share a significant amount of access resources, either macro and/or small cells, which may require

- Different PHY and convergence layers for different mm wave bands.
- IP Stack compatibility ported across different mm wave bands.
- Same PHY and MAC (for a given mm wave band) could be reused between broadband and wireless networks.

Future 5G networks may employ radio access sections re-usable between broadband and wireless networks.

** an average of 2% inflation yearly rate is acco*

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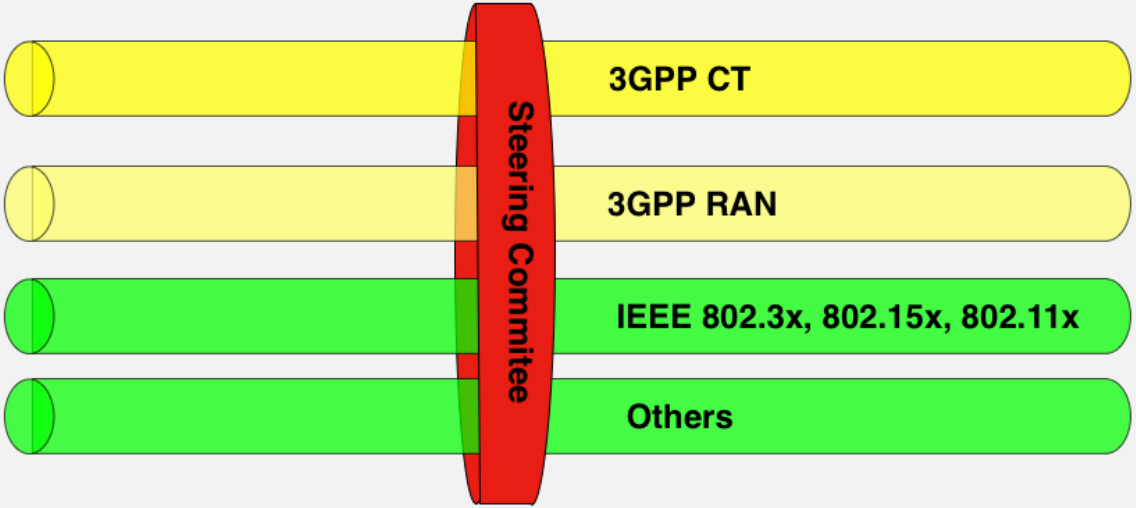
Standardization Process Considerations



Core Networks and Terminals

Radio Access Network

Fiber, Wi-Fi, PAN Standards

Other SDOs

- mm wave bands may become jointly shared by broadband and wireless networks.
- Each mm wave band will require its own PHY/MAC standard.
- Due to the number of candidate mm bands, cross SDO activity coordination becomes critical.
- In different regions, broadband and wireless carriers may use the same mm wave bands.

Cross SDO standard development may require joint steering committees enabling fluid and faster communications across SDOs, targeting the development of user centric network standards.

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Conclusions

- **Future 5G networks will be user centric, multiple networks being built around the end-user.**
- **Rolling out mm band access networks will require significant backhaul capabilities (capacity, latency). This could be achieved by a closer integration of fixed broadband and wireless networks.**
- **Future fixed broadband and wireless networks may re-use a significant amount of access resources.**
- **Same IP Stack could support multiple mm bands.**
- **Future mm bands access standards will be developed across multiple SDOs.**

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References

1. Cisco, “Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2014-2019”, Feb 2015
2. Ericsson, “Mobility Report”, June 2015

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